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## (54) WOUND DRESSING.

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## Description

A wound healing process may principally be subdivided into three phases. The wound is first cleaned out followed by the formation of new tissue, whereafter the restored tissues during a final maturing phase stabilize while developing a less brittle and more elastic structure.

The regeneration phase involves the growth of capillaries, fibroblasts and epithelium into the wound site for building up new tissue. The newly formed tissue is extremely delicate and supersensitive to external influences. If a wound still in progress of regenerating tissue is covered with a dressing composed of a fibrous material, the fibers may easily intermingle with the newly formed tissues and give rise to inflammatory reactions in the wound tissue, which would result in deterioration of the wound healing process. Furthermore, the wound tissue would also be mechanically damaged in connection with removal and change of dressing. To avoid this, it is extremely important for the dressing applied to the wound not to get stuck in dried-up wound exudate, or in any coagulum possibly formed. To attain the most favorable conditions for optimal wound healing, the wound should be kept moist but free of excess wound exudate during this phase of wound repair.

Wound dressings intended for use during this particularly sensitive stage of the wound healing process should therefore be designed so as not to stick to the wound bed; they should be pliable and have a soft wound-contacting surface. In addition, the dressings must be capable of seeping up excess amounts of wound fluid, or to allow for the passage of fluid exudate into an absorbent body placed over the dressing.

Commonly used types of dressings for application to wounds in the regenerating phase are pads soaked with ointment and made of gauze or nylon netting, possibly in combination with an absorbent body. Dressings of this type, as compared with conventional fibrous dressings, have a low tendency of sticking to the wound due to their poor adhesivity towards wound tissue. However, there are associated with the use of such dressings numerous draw-backs and disadvantages. For example, ointment easily falls off during use of this dressing admitting thereby a foreign substance to enter the wound, which would negatively affect the wound healing process. The pads soaked with ointment are smeary and unpleasant to handle and, although impregnated, they often stick tenaciously to the wound bed thus giving rise to tissue damages. A dressing of this type according to the introductory portion of claim 1 is known from US-A-2,764,976.

Another type of dressing used on wounds in the regenerating stage constitutes a combination of a perforated polymer or metal film and a more or less absorbent body made of a fibrous material. The idea is for the film to produce a non-frictional, hydrophobic wound-contacting surface preventing in this manner the dressing from sticking to the wound. Dressings of this type are stiff, inelastic and non-flexible. The greatest disadvantage with such prior art dressings, however, is the fact that despite their smooth surface, they still get stuck in the wound bed much too often.

With the present invention there has been achieved a wound dressing which does not stick to healing wound tissue and which substantially does not give off fibers or other components harmfully affecting the wound healing process.

A wound dressing according to the invention is defined in claim 1.

To accomplish a wound dressing having properties such as low tendency of sticking to wound tissue and poor solubility in aqueous media such as wound fluid for example, the gel incorporated in the dressing must necessarily be hydrophobic.

According to a particularly advantageous embodiment of the invention, the hydrophobic gel is a silicone gel.

The invention will be described in more detail below with reference to an exemplary embodiment illustrated in the accompanying drawing, of which

Fig. 1 is a plan view of a wound dressing according to the invention, and

Fig. 2 is a partially enlarged view of the dressing as shown in Fig. 1.

The dressing shown in Figs. 1 and 2 comprises a reinforcement 1 in the form of an elastic, hydrophobic, knitted network and a silicone gel layer 2 applied to seal around the threads of the reinforcement 1 which is thereby encapsulated by the gel. In order for the dressing to perform its optimal function, the encapsulation must be almost complete with only a strictly limited number of fiber ends being allowed to penetrate the silicone gel and project out of the dressing surface.

The gel must be securely fixed to the reinforcement I for maintaining the gel layer 2 substantially intact during use of the dressing, avoiding in this manner any disturbance of the wound healing process such as inflammatory reactions caused by loose gel fragments.

When, as in the example shown in Fig. 1, the gel seals around the structural elements included in the reinforcement 1 constituting here the individual threads 3 of the netting, it will form a continuous, three-dimensionally extended layer which is in itself strong enough to keep the reinforcement well encapsulated.

In order to provide a higher degree of security against disintegration of the gel layer, the reinforcing threads 3 may, as shown in Fig 2, be composed of a plurality of loosely twisted fibers 4. With such an arrangement the silicone gel will penetrate between each individual fiber in the threads of the netting,

adding in this manner to the strength of the gel layer.

Thus, the gel does not necessarily have to adhere to the reinforcement material for the dressing to present a continuous and stable outer layer of gel.

The openings 5 in the net allows for the passage of excess wound exudate through the dressing. For the treatment of wounds under regeneration of skin tissue, a dressing according to the invention is preferably combined with an absorbent bandage applied over the gel-coated netting. In this manner excessive amounts of wound exudate will be sucked up at the same time as the absorbent bandage is kept spaced from the wound bed thereby preventing the bandage from sticking to the wound. If necessary, the distance between the absorbent bandage and the wound tissue can be further increased by superimposing several layers of gel-coated netting on the wound surface before applying the absorbent bandage.

Owing to its flexibility and its capability of adhering to dry skin, the silicone gel netting can be easily affixed over the wound site. The strongly hydrophobic nature of the silicone gel prevents wound fluid from penetrating out over the healthy skin surrounding the wound and to loosen up skin tissue. The net-like structure of the dressing allows for the surrounding, healthy area of the skin to which the dressing is affixed to be maintained airy and rich in oxygen.

The net coated with silicone is easily reshapable and self-adhering, allowing thereby several layers of the net to be applied in a superimposed position. Due to its pliability, the dressing can further be used for filling in deer wound cavities enabling thereby the wound edges to be kept apart during the wound healing process. In this manner the wound is prevented from closing together by contraction of the wound edges while also reducing the risk of disfiguring and motion-inhibiting scars due to the gradual formation of new tissue from the wound edges, the wound cavity successively being filled in with regenerated tissue.

As an example of a silicone gel having the properties required for this purpose can be mentioned a type of gel marketed by Dow Corning under the registered tradename Dow Corning Q7-2218 - Silicone Gel System.

The hydrophobic character of the silicone gel makes it particularly useful as a carrier for medicaments soluble in fat such as pain-relieving substances, for example. It is also conceivable to have antibacterial agents, or agents stimulating wound repair, incorporated in the gel. An example of the last-mentioned type of agent is zinc.

The exemplary embodiment described in the foregoing is merely intended to illustrate the inventive concept without restricting its scope.

The silicone gel described in the example could naturally be replaced by any other hydrorhobic gel having similar properties in other respects. For example, polyurethane gel could be used as an alternative to silicone gel.

Many modifications of the invention are conceivable within the scope of the patent claims.

In a suitable embodiment the reinforcement could be made of a polyurethane foam being immersed in a bath of silicone gel to accomplish the wound dressing.

## Claims

1. A wound dressing comprising a hydrophobic layer which during use of the dressing lies in direct contact with the wound and which is permeable for liquid, whereby the hydrophobic layer comprises a hydrophobic substance which is deposited on a net-like reinforcement (1) made of elastic material, the substance substantially completely encapsulating all components of the reinforcement while preserving the porosity thereof, the hydrophobic layer thus including through-holes (5) which permit wound exudate to pass through said hydrophobic layer, characterized in that said hydrophobic substance consists of a soft and elastic gel (2) which is capable of adhering to dry skin.

2. A wound dressing according to Claim 1, characterized in that the hydrophobic gel (2) is a silicone gel.

3. A wound dressing according to Claim 1, characterized in that the hydrophobic gel (2) is a polyurethane gel.

4. A wound dressing according to Claim 1, characterized in that the reinforcement (1) is a soft, flexible and elastically extendable net of textile material.

5. A wound dressing according to Claim 2, characterized in that the netting has a knitted, crocheted or woven performance.

6. A wound dressing according to any one of the preceding claims, characterized in that the netting has 5 - 30 holes per $cm^2$, said holes (5) having a size of 0.25 - 4 $mm^2$.

7. A wound dressing according to Claim 1, characterized in that the reinforcement (1) consists of a polymeric foam with open cells.

## Patentansprüche

1. Wundverband, welcher eine hydrophobe Schicht umfaßt, welche während des Gebrauches des Verbandes in direkter Berührung mit der Wunde liegt und welche flüssigkeitsdurchlässig ist, wobei diese hydrophobe Schicht eine hydrophobe Substanz umfaßt, welche auf einer netzartigen, aus einem elastischen Material angefertigten Verstärkung (1) abgelagert ist, und wobei diese Substanz alle Komponenten der Verstärkung im wesentlichen vollständig einkapselt, zugleich aber die Porosität der

Verstärkung erhält, un wobei die hydrophobe Schicht somit durchgehende Löcher (5) enthält, welche es dem Wundexsudat ermöglichen, durch diese hydrophobe Schicht hindurchzutreten, dadurch gekennzeichnet, daß die hydrophobe Substanz aus einem weichen und elastischen Gel (2) besteht, welches befähigt ist, an trockener Haut anzuhaften.

2. Wundverband nach Anspruch 1, dadurch gekennzeichnet, daß das hydrophobe Gel (2) ein Silikongel ist.

3. Wundverband nach Anspruch 1, dadurch gekennzeichnet, daß das hydrophobe Gel (2) ein Polyurethangel ist.

4. Wundverband nach Anspruch 1, dadurch gekennzeichnet, daß die Verstärkung (1) ein weiches, beigsames und elastisch dehnbares Netz aus einem Textilmaterial ist.

5. Wundverband nach Anspruch 2, daduch gekennzeichnet, daß das Netzwerk ein solches von Strick- bzw. Wirkwaren-, Häkel- oder Webwarenqualität ist.

6. Wundverband nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß das Netzwerk 5 bis 30 Löcher je $cm^2$ aufweist, wobei diese Löcher (5) eine Größe von 0,25 bis 4 $mm^2$ haben.

7. Wundverband nach Anspruch 1, dadurch gekennzeichnet, daß die Verstärkung (1) aus einem offenzelligen Polymerschaum besteht.

**Revendications**

1. Pansement pour plaies comprenant une couche hydrophobe qui, pendant l'utilisation du pansement, se trouve en contact direct avec la plaie et qui est perméable aux liquides, cette couche hydrophobe comprenant un substance hydrophobe qui est déposée sur un renforcement (1) analogue à un filet formé d'une matière élastique, cette substance enfermant pratiquement tous les composants du renforcement tout en préservant la porosité de ce dernier, la couche hydrophobe comprenant ainsi des trous traversants (5) qui permettent à l'exsudat de la plaie de traverser ladite couche hydrophobe, caractérisé en ce que la substance hydrophobe consiste en un gel mou et élastique (2) qui est capable d'adhérer à une peau sèche.

2. Pansement pour plaies selon la renvendication 1, caractérisé en ce que le gel hydrophobe (2) est un gel de silicone.

3. Pansement pour plaies selon la revendication 1, caractérisé en ce que le gel hydrophobe (2) est un gel de polyuréthane.

4. Pansement pour plaies selon la revendication 1, caractérisé en ce que le renforcement (1) est un filet mou, flexible et extensible élastiquement formé d'une matière textile.

5. Pansement pour plaies selon la revendication 2, caractérisé en ce que le filet a le comportement d'un tissu tricoté, formé au crochet ou tissé ;

6. Pansement pour plaies selon l'une quelconque des revendications précédentes, caractérisé en ce que le filet comporte de 5 à 30 ouvertures par cm2, lesdites ouvertures (5) ayant une taille de 0,25 - 4 mm2;

7. Pansement pour plaies selon la revendication 1, caractérisé en ce que le renforcement (1) consiste en une mousse polymére à cellules ouvertes.

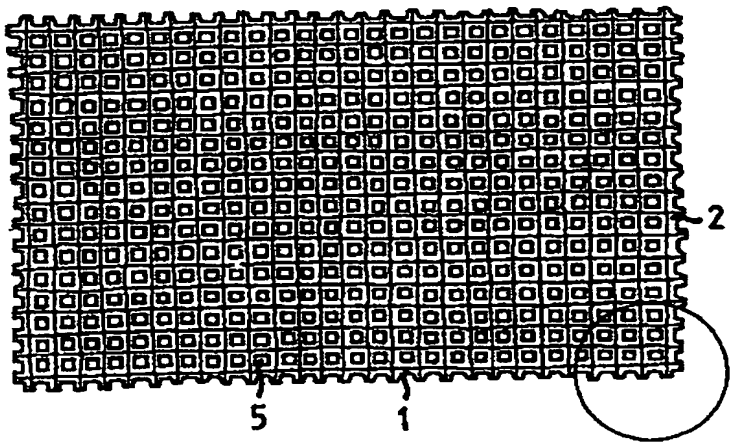


FIG 1

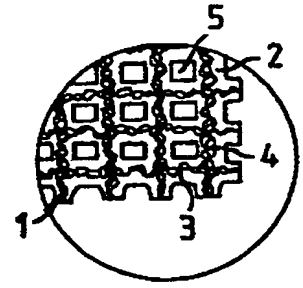


FIG 2